Learning by Doing

A Hands-On Science Activity Book

CBSE Science (086) · Class X · 2026–27

38 everyday activities · Puzzle corners · No rote learning

Every activity uses kitchen, stationery-drawer, or garden items — nothing sharp, flammable, or mains-powered.

How to Use This Book

- Start with the question, not the answer. Each activity opens with a hook question. Let students guess first — being wrong out loud is where curiosity starts.
- Do the activity before naming the concept. The formal term (like "phototropism" or "displacement reaction") is introduced only in the Think & Discuss step, after students have already seen it happen with their own hands.
- There is no single ‘correct’ answer paragraph. Think & Discuss prompts are open-ended by design. Use them for classroom talk, portfolio write-ups, or paired discussion — not for a model answer to copy.
- Everything is locally sourced. No item in this book needs a specialised lab-supply order — kitchen shelf, garden, or the school stationery cupboard covers it all.
- Follow the exam-weightage note in each unit. A short note at the start of every unit tells you which topics are summatively assessed this year and which are formative-only — useful for pacing, not for skipping.
- Puzzle Corners are for consolidation, not testing. Use them a day or two after the hands-on activities, once the vocabulary has already been used out loud at least once.
- Safety notes are non-negotiable. Wherever a Safety line appears, it is a hard rule, not a suggestion — mostly ‘adult supervises this one step’ or ‘wash hands after’.

A Note on This Year's Syllabus

The CBSE Class X Science (086) syllabus for 2026-27 restructures how much of the chemistry and biology units is formally examined. Within Unit I, only Chemical Reactions and Equations carries summative weight this year — Periodic Classification, Acids-Bases-Salts, Metals & Non-metals, and Carbon Compounds are taught in full but assessed only through Portfolio and Periodic Assessment. Within Unit II, Evolution follows the same formative-only path. This book still gives every one of those topics a proper hands-on activity, because the syllabus is explicit that the goal is “joyful and experiential” learning for its own sake, credited through the Portfolio — not just exam marks.

Activities are distributed across the five units roughly in proportion to their exam weightage — Unit I and Unit II (25 marks each) get 11 activities apiece, Unit III and Unit IV (12-13 marks) get 6 each, and Unit V (5 marks) gets 4 — for a total of 38 activities plus five Puzzle Corners.

Contents

Materials You'll Need — At a Glance

Every single item used across all 38 activities in this book, in one place. Nothing here needs a science-supply shop — it's all kitchen, stationery-drawer, or garden. Tick off what you already have at home or in the school store cupboard before you begin a unit.

☐ 2-3 lemons or potatoes	☐ A small plate
☐ 2-3 rajma/gram/chana seeds soaked overnight in water	☐ A small potted seedling (bean/gram sprouted in a cup works)
☐ 2-3 soaked gram/rajma/moong seeds	☐ A small torch bulb or LED with a matching resistor if it's an LED
☐ 3 labelled boxes: Wet/Biodegradable, Dry Recyclable, Reject	☐ A spoon
☐ 4 identical iron nails	☐ A stopwatch
☐ 4 small jars/glasses	☐ A stopwatch or phone timer
☐ 5-6 small cups	☐ A straw
☐ A 1.5V or 9V battery/cell	☐ A straw or pencil
☐ A 30 cm ruler	☐ A thermometer or just clean fingertips
☐ A battery (1.5V-9V)	☐ A torch or phone flashlight
☐ A battery, an LED (with resistor) or torch bulb, connecting wires — same simple circuit as Activity 1	☐ A torch/phone flashlight
☐ A battery, connecting wires (same simple circuit)	☐ A touch-me-not / chhui-mui plant (Mimosa pudica), commonly found growing wild along paths and in gardens
☐ A blank white wall or sheet of paper	☐ A white wall or sheet of paper as a screen
☐ A blank worksheet	☐ A wooden pencil with graphite exposed at both ends (sharpen both ends, and scrape a thin strip of wood off one side to expose the graphite core along its length)
☐ A calculator	☐ A worksheet
☐ A class or family survey sheet listing traits: tongue-rolling (yes/no), free vs attached earlobes, widow's peak (yes/no), handedness	☐ About 2-3 metres of thin insulated copper wire
☐ A clear glass	☐ Access to check labels/manuals of home appliances (fridge, AC) if available
☐ A clear glass filled with water	☐ An empty opaque bowl
☐ A clear glass of water	☐ An empty plastic bottle
☐ A clear glass or plastic tumbler	☐ An iron nail, cleaned with sandpaper
☐ A clear, wide-mouthed jar or bottle with a lid	☐ An old/unused CD or DVD
☐ A coin	☐ Baking soda (2 tsp)
☐ A collection of clean, dry waste samples from home: a fruit peel, a piece of paper, a plastic wrapper, a leaf, a bit of cloth, a small	☐ Baking soda or an antacid tablet (e.g., Eno/ENO-type)

piece of glass/metal (handled by an adult only if sharp)	
☐ A convex lens (magnifying glass) fixed into a hole cut at one end	☐ Cards with carbon-chain lengths (meth-, eth-, prop-, but-) and cards with endings (-ane, -ene, -yne, -ol, -al, -one) written separately
☐ A dark room	☐ Clear cellotape
☐ A distant bright object such as a window or a tube-light across the room	☐ Clear nail polish
☐ A few drops of milk	☐ Cling film or a lid with holes
☐ A fresh leaf (any broad, soft leaf — money plant/hibiscus works well)	☐ Coloured chalk/rangoli powder or crayons (optional, for the art element)
☐ A glass	☐ Connecting wires with crocodile clips if available
☐ A handful of pins or paperclips	☐ Cooking oil
☐ A large iron nail	☐ Copper coins or copper wire pieces
☐ A large, easily available flower — hibiscus (gudhal) works best	☐ Copper sulphate solution (a pinch dissolved in water — ask a school lab or hardware/garden shop, sold as a fungicide)
☐ A layer of small pebbles/gravel	☐ Cotton wool
☐ A layer of soil	☐ Dilute vinegar in 4 small glasses
☐ A little water	☐ Dried peas / chana / small clay balls (black for carbon, white for hydrogen)
☐ A long corridor or open ground	☐ Empty/labelled packets of: baking soda, washing soda, bleaching powder, a bottle of caustic soda drain cleaner (unopened, label only), a bag of Plaster of Paris or an old plaster-cast/chalk stick
☐ A magnifying glass (optional)	☐ Epsom salt / saunf-namak or any bath salt (2 tbsp)
☐ A magnifying glass or a convex lens	☐ Galvanised (zinc-coated) nails
☐ A magnifying glass or a smartphone camera set to macro/zoom	☐ Gloves (optional)
☐ A measuring tape	☐ Household liquids to test: lemon juice, soap water, milk, soda water, salt water, curd
☐ A measuring tape or chalk	☐ Index cards or paper slips, one per element, with symbol + atomic mass written on it (teacher prepares ~15 cards: Li, Na, K, Ca, Sr, Ba, Cl, Br, I, and a few others)
☐ A notebook for a daily 1-line log	☐ Insulated connecting wires (or wire strippped at both ends)
☐ A notepad	☐ Internal cardboard partitions (optional, to make a maze)
☐ A pair of old reading glasses / spectacles of two different powers, if available at home	☐ Lemon juice or vinegar

☐ A paperclip or drawing pin (to make a simple switch)	☐ Limewater (chuna water — a pinch of edible lime/chuna dissolved and settled in water, use only the clear liquid on top) or a bottle of clear lime-water from a pharmacy
☐ A partner	☐ OR a small mirror placed inside a bowl of water, tilted, in direct sunlight
☐ A pot of soil or a corner of a garden	☐ pH strips if available (or your Activity 5 turmeric/cabbage indicator)
☐ A recent household electricity bill (or a photo of one)	☐ Picture/text cards for major evolutionary milestones (first life, first fish, first land plants, dinosaurs, first mammals, first birds, early humans, modern humans) — teacher prepares in advance
☐ A reference sheet with CH_4 (methane), C_2H⁄ (ethene), C_2H_2 (ethyne) structures	☐ Salt
☐ A set of statement cards prepared by the teacher, mixing myths and facts about family planning methods, HIV/AIDS transmission, and reproductive health (based on the NCERT textbook content)	☐ Small strips/pieces of aluminium foil, iron nail, copper wire (from old electrical wire), and a galvanised (zinc-coated) nail
☐ A sheet of paper to lay out the parts	☐ The wattage labels on 5-6 home appliances (bulb, fan, fridge, iron, TV, etc.)
☐ A shiny stainless-steel spoon	☐ Toothpicks
☐ A shoebox	☐ Tracing paper or butter paper as a screen, fixed inside near the other end
☐ A shoebox with a single small hole cut in one side	☐ Turmeric powder (1 tsp mixed in a little alcohol-free hand sanitiser or diluted spirit) OR red cabbage/beetroot/hibiscus (gudhal) petals boiled in water
☐ A small balloon	☐ Two glasses of water
☐ A small fruit peel, a piece of paper, and a small piece of plastic wrapper — each placed inside its own small mesh bag or old stocking, individually labelled	☐ Vinegar or lemon juice (1/4 cup)
☐ A small hardy plant or a few seeds (moss, grass, or a small succulent cutting)	☐ Washing soda or 1 tsp quicklime chunk (teacher-supervised, in a metal bowl only)
☐ A small LED or a multimeter, if available	☐ Water
☐ A small magnetic compass	☐ Wet cotton wool
☐ A small object (a pencil or your own face)	

Unit I

Chemical Substances — Nature and Behaviour

Theme: Materials · Exam weightage: 25 marks · 11 activities

> Only “Chemical Reactions and Equations” is assessed in the year-end written exam this year. Periodic Classification, Acids-Bases-Salts, Metals & Non-metals, and Carbon Compounds are taught the same way but assessed formatively (Portfolio / Periodic Assessment) — so treat every activity below as equally worth doing, just not equally worth cramming.

Activity 1 · Fizz Detective

What tells you a chemical reaction actually happened — colour, gas, heat, or all three?

C 1.3 · Chemical Reactions and Equations (assessed) · Time: 20 minutes

You'll need

- Baking soda (2 tsp)
- Vinegar or lemon juice (1/4 cup)
- A small balloon
- An empty plastic bottle
- A spoon

Try it

1. Stretch the balloon a few times to loosen it, then spoon 2 tsp baking soda inside it.
2. Pour the vinegar into the bottle.
3. Fit the balloon's neck over the bottle mouth without letting the soda fall in yet.
4. Lift the balloon upright so the soda drops into the vinegar, and watch what happens to the balloon.
5. Repeat with double the soda and note if the balloon inflates faster or more.

Think & discuss

- Which new substance made the balloon rise? How do you know it wasn't just air being pushed?
- Write the word equation for what happened. Is this reaction combination, decomposition, or something else?
- Was heat given out or taken in — touch the bottle's side to check. What does that tell you about energy in this reaction?

Connect it

This is the same reaction used in fire-extinguisher demonstrations and in bread/idli batter rising with eno or baking soda — the CO_2 gas is doing the work in your kitchen every day.

Activity 2 · Hot or Cold?

Do all chemical reactions get hot, or can dissolving something make a glass feel cold?

C 1.3 · Endothermic and exothermic reactions (assessed) · Time: 15 minutes

You'll need

- Epsom salt / saunf-namak or any bath salt (2 tbsp)
- Washing soda or 1 tsp quicklime chunk (teacher-supervised, in a metal bowl only)
- Two glasses of water
- A thermometer or just clean fingertips

Try it

1. Note the starting temperature of both glasses of water (or just feel them — both should feel the same).
2. Stir the Epsom salt into glass 1 until it dissolves. Feel/measure the glass.
3. Under teacher supervision only, add a small piece of quicklime (or washing soda) to glass 2 in a metal bowl and stir with a spoon, standing back slightly.
4. Feel/measure both glasses again and record the difference.

Safety: Quicklime step is teacher-hands-only; students observe from a step back. Everyone washes hands after.

Think & discuss

- Which glass took in energy from its surroundings, and which gave energy out?
- If you were designing an instant cold-pack for a sports injury, which of today's two reactions would you use, and why?

Connect it

Instant cold packs sold at chemists use exactly this endothermic dissolving trick — no ice or fridge needed.

Activity 3 · The Corrosion Diary

Why does an iron gate rust near the sea but stay shiny inside a sealed steel almirah?

C 1.2 · Metals — corrosion and its prevention (formative) · Time: 10 minutes to set up, then 2 minutes/day for 2 weeks

You'll need

- 4 identical iron nails
- 4 small jars/glasses
- Water
- Cooking oil
- Salt
- Cotton wool
- A notebook for a daily 1-line log

Try it

1. Nail A: leave dry in an open jar (control).
2. Nail B: submerge fully in plain water.
3. Nail C: submerge in salt water (1 tsp salt in water).
4. Nail D: coat completely in cooking oil, then place in a dry jar.
5. Check all four nails at the same time each day for 2 weeks and log what you see in one line.

Think & discuss

- Rank the four nails from most to least rusted. What single factor explains nail C rusting fastest?
- Which nail proves that keeping air or water away prevents corrosion, and which real-world product uses that exact trick (paint, grease, galvanising)?

Connect it

This is why ships, railway tracks, and tools near coastal cities need extra rust-proofing, and why bicycle chains are oiled.

Activity 4 · The Colour-Changing Nail

Can one metal push another metal out of its own compound?

C 1.3 · Displacement reaction (assessed) · Time: 20 minutes

You'll need

- Copper sulphate solution (a pinch dissolved in water — ask a school lab or hardware/garden shop, sold as a fungicide)
- An iron nail, cleaned with sandpaper
- A clear glass
- Gloves (optional)

Try it

1. Pour the blue copper sulphate solution into the glass.
2. Drop in the cleaned iron nail and leave it undisturbed for 15 minutes.
3. Observe the nail's surface and the colour of the solution before and after.

Safety: Copper sulphate is mildly toxic if swallowed — handle with a spoon, don't taste, wash hands after, keep away from younger siblings.

Think & discuss

- What reddish-brown coating appeared on the nail, and what does that tell you about which metal is more reactive?
- Write the word equation. Which type of reaction is this — combination, displacement, or double displacement?

Connect it

This is the same principle used to purify copper and to explain why iron pipes shouldn't touch copper fittings directly in old plumbing.

Activity 5 · Kitchen Rainbow

How did people test acids and bases before litmus paper was invented?

C 1.2 · Acids and bases — indicators (formative) · Time: 25 minutes

You'll need

- Turmeric powder (1 tsp mixed in a little alcohol-free hand sanitiser or diluted spirit) OR red cabbage/beetroot/hibiscus (gudhal) petals boiled in water
- 5-6 small cups
- Household liquids to test: lemon juice, soap water, milk, soda water, salt water, curd

Try it

1. Prepare your natural indicator: soak turmeric paste on a strip of paper, or boil red cabbage/hibiscus petals in water and cool the coloured liquid.
2. Pour a small amount of each household liquid into its own cup.
3. Add a few drops of your natural indicator to each cup, or dip a turmeric-soaked strip.
4. Record the colour change for each liquid in a table: Liquid | Colour with indicator | Acid / Base / Neutral guess.

Think & discuss

- Which household liquids turned out to be acidic, and which basic? Did anything surprise you?
- Turmeric turns red/brown in a base and stays yellow in acid/neutral — why do you think turmeric stains on a white shirt turn reddish when soap (a base) is used to wash them?

Connect it

This is a genuine science-history activity — natural dyes like litmus (from lichen), turmeric, and hibiscus were humanity's original pH indicators long before synthetic litmus paper.

Activity 6 · Sour to Sweet

What actually happens, chemically, when you take an antacid tablet for acidity?

C 1.2 · Neutralisation (formative) · Time: 20 minutes

You'll need

- Lemon juice or vinegar
- Baking soda or an antacid tablet (e.g., Eno/ENO-type)
- pH strips if available (or your Activity 5 turmeric/cabbage indicator)
- A glass
- A spoon

Try it

1. Test the pH (or indicator colour) of plain lemon juice and record it.
2. Add a small pinch of baking soda, stir, and re-test.
3. Keep adding small pinches and re-testing until the fizzing stops and the pH is close to neutral.
4. Repeat with an antacid tablet in a cup of dilute vinegar (simulating stomach acid).

Think & discuss

- What gas caused the fizzing, and how would you prove it (hint: what happens if you hold a matchstick-free indicator flame — actually, what other test from Activity 1 could you reuse)?
- In one sentence, explain to a younger sibling why an antacid tablet stops a stomach ache.

Connect it

Farmers add lime (a base) to acidic soil for the same reason — neutralisation — and municipal water plants neutralise acidic waste water before releasing it.

Activity 7 · The Great Metal Race

If four metals all meet the same acid, who wins — who reacts fastest?

C 1.2 · Reactivity series (formative) · Time: 20 minutes

You'll need

- Small strips/pieces of aluminium foil, iron nail, copper wire (from old electrical wire), and a galvanised (zinc-coated) nail
- Dilute vinegar in 4 small glasses
- A stopwatch or phone timer

Try it

1. Drop one metal into each glass of vinegar at the same moment.
2. Watch for bubbles (hydrogen gas) forming on each metal's surface.
3. Time how long until bubbling clearly starts for each metal, or rank by bubble intensity after 5 minutes.

Think & discuss

- Rank the four metals from most to least reactive based on your evidence.
- Where would you place these four metals if you were building the standard reactivity series (K, Na, Ca... Au) — which end are they closer to?

Connect it

This is exactly why gold jewellery never tarnishes but an iron tool left in the monsoon rain does — reactivity decides real-world durability.

Activity 8 · Element Rangoli

Before the modern periodic table, how did scientists spot patterns in just a handful of known elements?

C 1.1 · Periodic classification — Döbereiner, Newlands (formative) · Time: 30 minutes

You'll need

- Index cards or paper slips, one per element, with symbol + atomic mass written on it (teacher prepares ~15 cards: Li, Na, K, Ca, Sr, Ba, Cl, Br, I, and a few others)
- Coloured chalk/rangoli powder or crayons (optional, for the art element)

Try it

1. Shuffle the element cards and lay them out atomic-mass side up.
2. Try to group any three elements whose middle atomic mass is close to the average of the other two — that's a Döbereiner Triad. Find as many as you can.
3. Now arrange all your cards in increasing atomic mass and mark every 8th element — do the properties repeat, as Newlands claimed with his Law of Octaves?
4. Optional: recreate your final groupings as a rangoli pattern on the floor/paper using colour to represent metals, non-metals, and metalloids.

Think & discuss

- Where did Newlands' Law of Octaves break down, and why do you think it stopped working after calcium?
- What single change did Mendeleev make that fixed the problems in both Döbereiner's and Newlands' ideas?

Connect it

This activity recreates real 19th-century scientific reasoning with a handful of cards — you're pattern-spotting exactly like Döbereiner, Newlands, and Mendeleev did, no memorising required.

Activity 9 · Molecule Modelling with Toothpicks and Peas

Why can carbon form millions of compounds when most elements form only a handful?

C 1.2 · Covalent bonds, versatile carbon, hydrocarbons (formative) · Time: 30 minutes

You'll need

- Dried peas / chana / small clay balls (black for carbon, white for hydrogen)
- Toothpicks
- A reference sheet with CH_4 (methane), C_2H⁄ (ethene), C_2H_2 (ethyne) structures

Try it

1. Build methane: one black ball with 4 toothpicks going to 4 white balls.
2. Build ethane: two black balls joined by one toothpick, each also holding 3 white balls.
3. Build ethene: two black balls joined by two toothpicks (a double bond), each holding 2 white balls.
4. Build ethyne: two black balls joined by three toothpicks (a triple bond), each holding 1 white ball.

Think & discuss

- Which of your four models is saturated and which are unsaturated? How can you tell just by counting toothpicks between the carbons?
- If you add a chlorine atom (a new colour ball) in place of one hydrogen, what would you now call this compound?

Connect it

LPG cylinders in Indian kitchens are mostly the saturated hydrocarbon butane, while the unsaturated ones you built are the basis of plastics and synthetic fibres.

Activity 10 · Name That Compound

Can you invent your own quick rulebook for naming carbon compounds, the way chemists did?

C 1.2 · Homologous series, nomenclature (formative) · Time: 20 minutes

You'll need

- Cards with carbon-chain lengths (meth-, eth-, prop-, but-) and cards with endings (-ane, -ene, -yne, -ol, -al, -one) written separately
- A blank worksheet

Try it

1. Shuffle the two sets of cards separately.
2. In pairs, draw one chain-length card and one ending card, combine them, and try to name and roughly sketch the compound.
3. Race against another pair: whoever correctly names and classifies (alkane/alkene/alkyne/alcohol/aldehyde/ketone) five combinations first wins.

Think & discuss

- What does the ending tell you that the chain-length prefix doesn't, and vice versa?
- Ethanol and ethanoic acid share the same 2-carbon chain — what's different about their endings, and how does that show up in their real-world uses (drinks/sanitiser vs vinegar)?

Connect it

This naming logic is exactly how a chemist reads any ingredient label — spotting "-ol" or "-anoic acid" instantly tells them the compound's family.

Activity 11 · Kitchen Chemistry Cabinet

How many chemical compounds are already sitting in your kitchen and bathroom shelf, unnamed?

C 1.2 · Common compounds — NaOH, bleaching powder, baking soda, washing soda, Plaster of Paris (formative) · Time: 20 minutes

You'll need

- Empty/labelled packets of: baking soda, washing soda, bleaching powder, a bottle of caustic soda drain cleaner (unopened, label only), a bag of Plaster of Paris or an old plaster-cast/chalk stick
- A worksheet

Try it

1. Collect (or photograph) the labels of each item at home.
2. For each, write down: its chemical name, chemical formula, and its everyday use as stated or implied on the label.
3. Sort all five into a table: Used for cleaning / Used for cooking / Used for construction or first-aid.

Think & discuss

- Which one compound appears on more than one shelf under two different common names, and why might that be confusing for a consumer?
- If a compound's label says "corrosive, avoid skin contact," what does that tell you about its chemical nature (acidic/basic) even without testing it?

Connect it

This is literally how a chemist or a pharmacist reads a product label — the activity turns your own home into a chemistry museum.

Unit I · Puzzle Corner

Chemistry Word Hunt

A	L	L	H	Y	D	R	O	C	A	R	B	O	N	C
B	G	I	K	Q	F	C	O	R	R	O	S	I	O	N
E	L	I	C	X	L	Q	M	K	H	L	M	S	E	B
Q	A	S	D	I	R	O	J	G	Q	M	P	J	R	P
O	S	O	N	I	B	C	X	B	M	Z	O	A	K	D
R	W	M	Z	X	S	Z	A	I	L	P	G	D	M	C
E	W	E	F	X	G	P	O	T	D	G	V	W	E	R
D	M	R	Z	K	K	O	L	Y	A	A	U	K	D	E
U	V	K	D	C	Y	V	T	A	L	L	T	P	J	Y
C	N	M	Z	O	H	M	N	E	C	H	Y	I	R	E
T	B	Z	F	R	J	S	N	R	R	E	Z	S	O	K
I	U	B	Q	L	R	C	Z	U	R	N	M	X	T	N
O	X	K	I	V	Y	S	X	K	H	Z	S	E	Z	Y
N	Z	R	E	A	C	T	I	V	I	T	Y	T	N	H
U	P	R	E	C	I	P	I	T	A	T	E	O	G	T

Find: OXIDATION • REDUCTION • DISPLACEMENT • PRECIPITATE • CATALYST • VALENCY • CORROSION • REACTIVITY • ISOMER • HYDROCARBON

Unscramble the Reaction Types

1. **NOOICMNBAIT** → _____
2. **SOICMOTIONDEP** → _____
3. **TECPLADSMEN** → _____
4. **MOHECTREXIC** → _____
5. **IDNOCETMRHE** → _____
6. **OXTDNAOII** → _____

Match the Compound to Its Common Name

Column A	Column B
1. Sodium hydrogen carbonate	A. Washing soda
2. Sodium hydroxide	B. Bleaching powder
3. Calcium sulphate hemihydrate	C. Baking soda
4. Sodium carbonate	D. Caustic soda
5. Calcium oxychloride	E. Plaster of Paris

Unit II

World of Living

Theme: The World of the Living · Exam weightage: 25 marks · 11 activities

> Life Processes, Control & Coordination, Reproduction, and Heredity are all assessed in the written exam. Evolution is taught but assessed only formatively (Portfolio) — still worth the timeline walk, since it ties Heredity and Evolution together conceptually.

Activity 12 · Breath of Life

You breathe out air every few seconds — but what proof do you actually have that it's different from the air you breathe in?

C 3.2 · Respiration (assessed) · Time: 15 minutes

You'll need

- Limewater (chuna water — a pinch of edible lime/chuna dissolved and settled in water, use only the clear liquid on top) or a bottle of clear lime-water from a pharmacy
- A straw
- A clear glass

Try it

1. Pour clear limewater into the glass.
2. Gently blow out through the straw into the limewater for about 30 seconds (do not inhale through the straw).
3. Watch the limewater's colour and clarity change.
4. For comparison, use a second straw to just bubble ordinary room air through a fresh glass of limewater using a small pump/balloon, and compare.

Think & discuss

- What turned the limewater milky, and which gas is responsible?
- Why did room air pumped through take longer (or not manage) to turn it milky compared to your breath?

Connect it

This exact limewater test is used in labs to detect CO_2 leaks and is the chemistry behind why closed, poorly ventilated rooms full of people feel stuffy.

Activity 13 · Leaf's Secret Pores

How does a leaf 'breathe' and lose water without any visible holes?

C 3.2 · Exchange of materials — stomata (assessed) · Time: 25 minutes

You'll need

- A fresh leaf (any broad, soft leaf — money plant/hibiscus works well)
- Clear nail polish
- Clear cellotape
- A magnifying glass or a smartphone camera set to macro/zoom

Try it

1. Paint a thin layer of clear nail polish on the underside of the leaf, over a small patch.
2. Let it dry completely (5-10 minutes) until it peels as a clear film.
3. Peel it off carefully using tape, and stick the film flat onto a piece of paper.

4. Examine the peel under a magnifying glass or a zoomed phone camera and count the tiny mouth-shaped openings.

Think & discuss

- Are there more of these openings on the underside or the top of the leaf you tested — why might a plant evolve that pattern?
- These openings are called stomata. What two things do you think pass through them, based on what you already know about photosynthesis and respiration?

Connect it

This nail-polish peel technique is a genuine, simplified version of the method botanists use to count stomatal density when studying drought-resistant crop varieties.

Activity 14 · Chasing the Light

If you sealed a growing plant in a box with just one small hole, where would it try to grow?

C 3.2 · Tropic movements — phototropism (assessed) · Time: 10 minutes to set up, observe over 10-14 days

You'll need

- A small potted seedling (bean/gram sprouted in a cup works)
- A shoebox with a single small hole cut in one side
- Internal cardboard partitions (optional, to make a maze)

Try it

1. Place the potted seedling inside the shoebox.
2. Close the lid so the only light enters through the single hole.
3. Keep the box near a window with the hole facing the light, and check on it every 2 days without disturbing the plant's position.
4. Sketch the stem's direction each time you check.

Think & discuss

- Which direction did the stem bend toward, and how many days did it take to become clearly visible?
- Which plant hormone is responsible for this bending, and on which side of the stem does it accumulate more?

Connect it

Every houseplant that leans toward a window is doing exactly this — phototropism — which is why gardeners rotate pots regularly for even growth.

Activity 15 · Root Compass

Do roots always grow 'down' because of gravity, or because that's just where the water usually is?

C 3.2 · Tropic movements — geotropism/hydrotropism (assessed) · Time: 10 minutes to set up, observe over 5-7 days

You'll need

- 2-3 soaked gram/rajma/moong seeds
- Wet cotton wool
- A clear glass or plastic tumbler
- Cling film or a lid with holes

Try it

1. Line the inside wall of the tumbler with wet cotton and tuck the soaked seeds between the cotton and the glass so you can see them from outside.
2. Keep the tumbler upright for 2 days until roots and shoots emerge and are clearly visible from the side.
3. Now lay the tumbler on its side (horizontally) and keep the cotton damp.
4. Check daily and sketch which way the root and shoot each redirect their growth.

Think & discuss

- After you turned the tumbler sideways, which direction did the root bend towards, and which did the shoot bend towards?
- Design a follow-up test to find out whether the root was responding to gravity or to where the moisture was — what would you change?

Connect it

Farmers rely on this exact root behaviour (positive geotropism) when sowing seeds at an angle on sloped fields — the roots find their way down regardless.

Activity 16 · Touch-Me-Not Investigation

Can a plant 'feel' your touch and react in seconds, without a nervous system?

C 3.2 · Control and coordination in plants (assessed) · Time: 15 minutes

You'll need

- A touch-me-not / chhui-mui plant (Mimosa pudica), commonly found growing wild along paths and in gardens
- A stopwatch

Try it

1. Locate a Mimosa pudica plant and gently touch one leaflet with a fingertip or a twig.
2. Time how long it takes for that leaflet, and then the whole leaf, to fold.
3. Try a very light touch versus a firmer touch and compare the speed/extent of folding.
4. Wait 20-30 minutes and check if the leaves have reopened.

Think & discuss

- This response happens far faster than a plant growing toward light (Activity 3). What does that tell you about how this signal travels, compared to a slow growth-based tropism?
- Why might folding up when touched be a useful survival trait for this plant (think about grazing animals)?

Connect it

This immediate, non-growth movement (called a nastic movement) is one of the closest things to plant 'reflexes' — and Mimosa pudica grows wild in most Indian neighbourhoods, so you can repeat this test anytime.

Activity 17 · Reflex & Reaction Time Lab

How much of what your body does happens before your brain even 'decides' anything?

C 3.2 · Nervous system — voluntary, involuntary, reflex action (assessed) · Time: 20 minutes

You'll need

- A 30 cm ruler
- A torch/phone flashlight

- A partner

Try it

1. Reaction-time station: your partner holds a ruler vertically, its zero-mark between your open thumb and finger, and drops it without warning. Catch it and note the cm mark where you caught it. Repeat 5 times.
2. Pupil-reflex station: sit in a dim area for a minute, then have your partner briefly shine a torch into one eye from the side while you both watch that pupil.
3. Optional knee-jerk station: sit on a high stool/table with legs dangling, and have your partner gently tap just below your kneecap with the edge of a soft notebook (light, painless tap only).

Safety: Knee tap must be gentle with a soft object only — never a hard or sharp object, and never near the kneecap's bone edge forcefully.

Think & discuss

- For the ruler test, did your catching distance improve with practice? Is that expected for a true reflex, or does that suggest something else is happening?
- The pupil reaction and the knee-jerk happen without you consciously deciding — rank all three of today's tests as voluntary, involuntary, or reflex, and justify each.

Connect it

Doctors use the knee-jerk and pupil-light reflex tests in every basic physical check-up specifically because they test the nervous system without needing the patient to consciously respond.

Activity 18 · Ballooning Bean

A seed looks solid and lifeless — what's actually packed inside, waiting?

C 3.2 / C 3.3 · Reproduction — seed structure (assessed) · Time: 20 minutes (after an overnight soak)

You'll need

- 2-3 rajma/gram/chana seeds soaked overnight in water
- A small plate
- A magnifying glass (optional)

Try it

1. Drain the soaked seeds and gently peel off the outer seed coat with your fingers.
2. Carefully split the seed along its natural line into two halves (cotyledons).
3. Look for the small embryo structure — a tiny curled plantlet — tucked at one end.
4. Sketch and label what you find: seed coat, cotyledons, embryo (plumule and radicle if visible).

Think & discuss

- What do you think the two large cotyledon halves are for, given that the seed has no soil or sunlight yet when it starts growing?
- How is this dicot seed structure different from what you'd expect in a single grain of rice or wheat (a monocot)?

Connect it

This is Practical #14 from your syllabus — every rajma or chana you soak for tomorrow's breakfast is a ready-made lab specimen.

Activity 19 · Flower Detective

A flower isn't just decoration — it's a reproductive organ. Can you find its 'male' and 'female' parts?

C 3.2 · Reproduction in plants (assessed) · Time: 20 minutes

You'll need

- A large, easily available flower — hibiscus (gudhal) works best
- A magnifying glass (optional)
- A sheet of paper to lay out the parts

Try it

1. Carefully pull off the petals one by one and set them aside, noting how many there are.
2. Identify the thin stalks with pollen-dusted tips near the centre — these are the stamens (male part).
3. Identify the single central long structure, often with a sticky or branched tip — this is the pistil (female part), running down to the ovary at its base.
4. Gently slice the ovary at the very base of the pistil (if your teacher permits) and look for tiny ovules inside.

Think & discuss

- If pollen from this same flower's stamens reaches its own pistil, is that self-pollination or cross-pollination?
- Why might a flower's bright colour and scent matter more for cross-pollination than for self-pollination?

Connect it

Hibiscus is used in exactly this activity in NCERT labs across India because its parts are unusually large and easy to identify without a microscope.

Activity 20 · Family Tree of Traits

Can you find Mendel's laws at work in your own classroom, without a single pea plant?

C 4.4 · Mendel's laws of inheritance (assessed) · Time: 30 minutes

You'll need

- A class or family survey sheet listing traits: tongue-rolling (yes/no), free vs attached earlobes, widow's peak (yes/no), handedness

Try it

1. Survey at least 15-20 classmates or family members for each trait, marking yes/no for each.
2. Tally the results into a simple frequency table for each trait.
3. For one trait (e.g., tongue-rolling, which is dominant), try building a simple Punnett square assuming one parent is Tt and the other tt, and predict the expected ratio.
4. Compare your real survey ratio to Mendel's predicted ratio.

Think & discuss

- Does your real-world survey ratio match the Punnett square prediction exactly? Why might a small real sample not match a theoretical ratio perfectly?
- Which of your surveyed traits do you think is dominant and which recessive, based on which appeared more often — and is 'more common' always the same as 'dominant'?

Connect it

This is exactly the logic geneticists use in real pedigree charts for human traits and inherited conditions — you've just built one from your own classroom.

Activity 21 · Fossil Story Timeline Walk

If you had to lay out 4 billion years of life on a school corridor, where would humans even fit?

C 4.5 · Evolution and evidence (formative) · Time: 25 minutes

You'll need

- Picture/text cards for major evolutionary milestones (first life, first fish, first land plants, dinosaurs, first mammals, first birds, early humans, modern humans) — teacher prepares in advance
- A long corridor or open ground
- A measuring tape or chalk

Try it

1. Mark a starting point representing 4 billion years ago and an endpoint representing today.
2. As a class, decide roughly where each milestone card should be placed along that timeline, using relative reasoning (e.g., 'land plants came after fish, but long before dinosaurs').
3. Walk the timeline from start to end, reading out each card as you reach it.
4. Stand at the very end and estimate how much of the total walk represents human existence.

Think & discuss

- How did it feel to physically walk how 'late' humans appear on this timeline? Did that surprise you?
- What kind of evidence (a fossil, a rock layer, a living relative species) would convince you that two milestone cards are placed in the wrong order?

Connect it

Museums use this exact 'walk the timeline' technique because reading '4 billion years' as a number doesn't register the way physically walking that scale does.

Activity 22 · Myth or Fact?

How much of what you've 'heard' about reproductive health and HIV/AIDS is actually accurate?

C 3.2 · Reproductive health, family planning, HIV/AIDS awareness (assessed) · Time: 25 minutes, teacher-guided discussion

You'll need

- A set of statement cards prepared by the teacher, mixing myths and facts about family planning methods, HIV/AIDS transmission, and reproductive health (based on the NCERT textbook content)

Try it

1. Working in small groups, sort each statement card into 'Myth' or 'Fact' before any discussion.
2. As a class, go through each card and have the teacher confirm the correct answer with a brief factual explanation.
3. Discuss why certain myths are so widely believed despite being incorrect.
4. Each group writes one sentence summarising one method of family planning and one accurate fact about HIV/AIDS transmission, in their own words.

Think & discuss

- Which myth on the cards did your group get wrong, and why do you think that misconception spreads so easily?
- Why does the syllabus group 'reproductive health' together with 'family planning' and 'HIV/AIDS awareness' under one heading rather than treating them separately?

Connect it

This card-sort format mirrors how public health campaigns (like those run by NACO, India's HIV/AIDS control body) correct misinformation at a population scale.

Unit II · Puzzle Corner

Biology Word Hunt

T	E	J	R	Z	Q	X	O	S	N	X	A	N	E	J
B	H	M	B	S	T	R	O	P	I	S	M	C	W	N
P	W	E	P	Z	O	C	X	T	A	C	Z	D	G	Z
S	I	M	R	Q	N	F	S	J	N	S	Z	R	K	C
U	E	S	R	E	T	L	U	M	A	L	N	M	V	X
P	D	L	T	T	D	Q	L	L	S	E	U	A	O	S
Q	C	U	M	I	Q	I	F	Q	T	U	D	D	T	W
S	H	M	H	J	L	U	T	K	I	P	H	A	E	M
Q	R	M	H	X	V	A	S	Y	C	O	M	V	U	G
O	K	R	O	D	I	T	C	G	R	E	R	T	I	G
V	W	C	S	R	O	M	E	M	N	E	A	A	O	N
U	N	E	J	M	V	C	O	N	F	T	X	H	Q	T
L	K	T	A	U	L	N	A	L	I	Z	R	O	D	D
E	W	T	C	J	E	Q	E	O	X	W	G	Z	L	V
P	A	F	N	A	U	X	N	H	S	T	Q	E	J	I

Find: STOMATA • TROPISM • REFLEX • HORMONE • PISTIL • STAMEN • HEREDITY • MUTATION • OVULE • NASTIC

Fill in the Blanks — Life Processes

1. The tiny pores on a leaf's surface, used for gas exchange, are called _____.
2. The bending of a plant's stem towards light is called _____.
3. An action that happens automatically, without the brain consciously deciding, is called a _____.
4. The male reproductive part of a flower is called the _____.
5. Gregor Mendel used _____ plants to discover the laws of inheritance.

Odd One Out

1. Stomata • Xylem • Phloem • Pupil

2. Combination • Displacement • Phototropism • Decomposition

3. Turmeric • Litmus • Hibiscus juice • Copper sulphate

Unit III

Natural Phenomena

Theme: Natural Phenomena · Exam weightage: 12 marks · 6 activities

> This whole unit — reflection, refraction, lenses, the eye, and dispersion — is assessed in the written exam. Every activity below is a frugal, at-home preview before you handle the actual lab mirrors, lenses, and prism in school.

Activity 23 · Spoon Mirror Magic

A shiny steel spoon has two curved mirrors built into it. Have you ever compared them on purpose?

C 2.3 · Reflection by curved mirrors (assessed) · Time: 15 minutes

You'll need

- A shiny stainless-steel spoon
- A small object (a pencil or your own face)

Try it

1. Look at your reflection in the inside (concave) bowl of the spoon, held close to your face.
2. Slowly move the spoon away from your face and watch what happens to the image at different distances.
3. Now flip the spoon and repeat with the outside (convex) back of the spoon, at several distances.
4. Note, at each distance, whether the image is upright/inverted and enlarged/diminished.

Think & discuss

- At what point (roughly) did your concave-side image flip from upright-and-enlarged to inverted? What does that tell you about the mirror's focal length compared to spoon-to-face distance?
- Did the convex side ever produce an inverted image, at any distance you tried? Why might that make convex mirrors more predictable for a specific real-world use?

Connect it

This is the same physical curve used in shaving/make-up mirrors (concave) and in vehicle side mirrors and shop security mirrors (convex), just scaled up.

Activity 24 · Bent Straw, Vanishing Coin

Can light really change direction just by entering a different substance — and can you see it happen?

C 2.3 · Refraction (assessed) · Time: 15 minutes

You'll need

- A clear glass of water
- A straw or pencil
- An empty opaque bowl
- A coin

Try it

1. Place the straw/pencil into the glass of water at an angle and look at it from the side.
2. Sketch what you see happening at the water's surface.
3. Place a coin at the bottom of the empty bowl and position your eye so the coin is just out of sight over the bowl's rim.
4. Without moving your head, slowly pour water into the bowl and watch the coin.

Think & discuss

- In both cases, is light actually bending, or is your brain misinterpreting where the light is coming from? Explain the difference between the two ideas.
- Which direction does light bend when going from air into water — towards the normal or away from it? Use your straw sketch to justify your answer.

Connect it

Refraction like this is why a fisherman using a spear (in traditional fishing) has to aim below where a fish appears to be — the water shifts its apparent position.

Activity 25 · Distant Window Focus

Can you actually 'catch' the focal point of a lens on a wall, and measure it?

C 2.3 · Lenses — focal length (assessed) · Time: 15 minutes

You'll need

- A magnifying glass or a convex lens
- A blank white wall or sheet of paper
- A measuring tape
- A distant bright object such as a window or a tube-light across the room

Try it

1. Hold the lens facing a distant bright window or light, with the white sheet/wall on the opposite side acting as a screen.
2. Slowly move the lens back and forth until you see a sharp, small, clear image of the window/light on the screen.
3. Measure the distance from the lens to the screen at that sharpest point.
4. Repeat 3 times and average your readings.

Safety: Point the lens only at a window/tube-light, never directly at the sun, and never let the focused spot fall on paper for more than a few seconds to avoid any scorching.

Think & discuss

- The distance you measured is (approximately) the lens's focal length, since the object is very far away. Is the image on your screen upright or inverted, and real or virtual?
- If you used a lens with a smaller focal length, would you expect it to be more curved or less curved than the one you tested?

Connect it

This is a safe, direct hands-on preview of Practical #10(b) from your syllabus — finding the focal length of a convex lens using a distant object.

Activity 26 · Shoebox Eye Model

Can you build a working model of your own eye out of a cardboard box?

C 2.3 · The human eye and defects of vision (assessed) · Time: 30 minutes

You'll need

- A shoebox
- A convex lens (magnifying glass) fixed into a hole cut at one end
- Tracing paper or butter paper as a screen, fixed inside near the other end

- A pair of old reading glasses / spectacles of two different powers, if available at home

Try it

1. Cut a hole at one end of the shoebox and fix the convex lens over it, facing outward.
2. Fix the tracing paper screen inside, a little distance behind the lens, and cut a small viewing hole in the box to see it.
3. Point the lens end toward a bright window and slide the screen back and forth until a sharp inverted image forms on it — this models your retina.
4. If you have two old spectacles of different powers, hold each in front of your model's lens in turn and see how the image sharpness/screen position needs to change.

Think & discuss

- Which part of your model represents the eye's cornea+lens system, and which represents the retina?
- If a real eye's image forms in front of the retina instead of on it, is that myopia (near-sightedness) or hypermetropia (far-sightedness)? Which type of spectacle lens (converging or diverging) would correct it?

Connect it

Opticians use this exact converging-lens principle when prescribing corrective glasses — your shoebox is a rough, physical version of the eye-testing logic used in every optician's shop.

Activity 27 · Bathroom Rainbow

Do you need an expensive glass prism to split white light into a rainbow?

C 2.3 · Dispersion of light (assessed) · Time: 15 minutes

You'll need

- An old/unused CD or DVD
- OR a small mirror placed inside a bowl of water, tilted, in direct sunlight
- A white wall or sheet of paper as a screen

Try it

1. Method A: Hold the CD's shiny side up at an angle in direct sunlight and tilt it slowly until you see coloured bands reflected onto a nearby white wall or ceiling.
2. Method B: Place a small mirror tilted inside a bowl of water in direct sunlight, and slowly adjust the angle until a spectrum appears on a wall.
3. Record the order of colours you observe from top to bottom or left to right.

Think & discuss

- Does the order of colours you observed match the standard VIBGYOR sequence? If your method gave a different or partial set of colours, what might explain that (e.g., CDs use diffraction, not pure refraction like a prism)?
- Why does white light split into colours here but a laser pointer's light (if you've seen one) doesn't split at all?

Connect it

This is a frugal-science substitute for a real glass prism, useful anywhere a lab prism isn't available — the water-and-mirror version is a genuine 19th-century physics-teaching trick.

Activity 28 · Milk & Torch

Why is the sky blue and a sunset orange — can you recreate that with milk and a torch?

C 2.3 · Scattering of light (assessed) · Time: 15 minutes

You'll need

- A clear glass filled with water
- A few drops of milk
- A torch or phone flashlight
- A dark room

Try it

1. Add just 2-3 drops of milk to the clear water and stir gently until it looks very faintly cloudy.
2. In a dark room, shine the torch through the glass from one side and look at the water from the side (at 90° to the torch beam).
3. Now look at the water from directly opposite the torch, in line with the beam.
4. Note the colour of the light in each viewing position.

Think & discuss

- What colour did the water appear from the side, and what colour did the torch beam look like when viewed straight through? Which colour of light scatters more, and which travels straight through more easily?
- Using your observation, explain (in your own words) why the sky looks blue during the day but the sun looks reddish-orange near sunrise/sunset. (Note: you are not required to explain the exact sunset mechanism in your exam — this is for understanding only.)

Connect it

This milk-and-water trick is a standard classroom model for the Tyndall effect and atmospheric scattering, used by physics teachers worldwide because it needs no special equipment.

Unit III · Puzzle Corner

Unscramble the Optics Terms

1. **OCACNVE** → _____
2. **VECXNO** → _____
3. **TRAOCFIRNE** → _____
4. **PROSDINSEI** → _____
5. **TRATCESGIN** → _____
6. **OFACL HELTGN** → _____

Match the Term to Its Meaning

Column A	Column B
1. Myopia	A. Ability to see nearby objects clearly, but not distant ones
2. Hypermetropia	B. Ratio of image height to object height
3. Magnification	C. A measure of how much a medium bends light
4. Refractive index	D. Ability to see distant objects clearly, but not nearby ones
5. Power of a lens	E. The reciprocal of a lens's focal length (in metres)

Unit IV

Effects of Current

Theme: How Things Work · Exam weightage: 13 marks · 6 activities

> Every activity here uses only low-voltage dry cells (1.5V-9V) — never mains electricity. This whole unit, including magnetic effects, is assessed in the written exam; the motor, electromagnetic induction, and generator are formative-only additions.

Activity 29 · Build Your Own Simple Circuit

What is the minimum you need to light a bulb — and what happens the moment one link in the chain breaks?

C 2.4 · Electric current, simple circuits (assessed) · Time: 20 minutes

You'll need

- A 1.5V or 9V battery/cell
- A small torch bulb or LED with a matching resistor if it's an LED
- Insulated connecting wires (or wire strippped at both ends)
- A paperclip or drawing pin (to make a simple switch)

Try it

1. Connect the battery, bulb, and wires into a single closed loop and confirm the bulb lights up.
2. Deliberately create a gap in the loop (remove one wire) and confirm the bulb goes off.
3. Insert a paperclip switch into the gap so you can open/close the circuit by lifting/lowering the clip.
4. Now add a second identical bulb in series (one after another) and observe brightness; then rewire both bulbs in parallel (each with its own path back to the battery) and compare brightness again.

Think & discuss

- Why did the bulbs dim in series but stay bright in parallel? What does that tell you about how current divides in each arrangement?
- If one bulb in your series circuit is removed, what happens to the other bulb? Repeat the test with the parallel circuit — is the result different? Which arrangement matches how the lights in your home are wired, and why is that a safer design?

Connect it

This is exactly why one blown bulb in an old-style serial fairy light string kills the whole string, while one bulb in your home going off never affects the rest of the house.

Activity 30 · Lemon Power Station

Can a lemon actually produce electricity, or is that just a myth?

C 2.4 · Potential difference and current (assessed) · Time: 20 minutes

You'll need

- 2-3 lemons or potatoes
- Copper coins or copper wire pieces
- Galvanised (zinc-coated) nails
- Connecting wires with crocodile clips if available
- A small LED or a multimeter, if available

Try it

1. Push one copper coin/wire and one zinc-coated nail into each lemon, close together but not touching.

2. Connect the copper of lemon 1 to the zinc of lemon 2 with a wire, and repeat for lemon 2 to lemon 3, chaining them (like cells in series).
3. Connect the one remaining free copper end and one remaining free zinc end to your LED or multimeter.
4. Check for a small glow (a very low-power LED) or a voltage reading.

Think & discuss

- Which two metals are acting as your circuit's electrodes, and which do you think is losing electrons (oxidised) and which is gaining them?
- Why did you need to chain multiple lemons together instead of using just one? What does that tell you about the potential difference a single lemon cell can produce?

Connect it

This is a genuine simple voltaic cell — the same basic chemistry (two different metals + an electrolyte) used inside every dry-cell battery you buy from a shop.

Activity 31 · Resistance Detective

Can a plain pencil control how bright a bulb glows?

C 2.4 · Resistance, resistivity, and the factors it depends on (assessed) · Time: 20 minutes

You'll need

- A battery, an LED (with resistor) or torch bulb, connecting wires — same simple circuit as Activity 1
- A wooden pencil with graphite exposed at both ends (sharpen both ends, and scrape a thin strip of wood off one side to expose the graphite core along its length)

Try it

1. Insert the pencil's exposed graphite into your simple circuit in place of a plain wire, connecting the clips at the very tips (shortest possible graphite path) and note the bulb's brightness.
2. Move one connecting clip further along the exposed graphite strip so the current now travels a longer graphite path, and note the brightness again.
3. If you have a second, thicker pencil or a mechanical pencil lead, test that too and compare.

Think & discuss

- As the graphite path got longer, did the bulb get brighter or dimmer? What does that tell you about the relationship between a conductor's length and its resistance?
- Graphite is not as good a conductor as copper wire. Based on your circuit's overall dimmer glow compared to Activity 1, what does that tell you about resistivity as a material property?

Connect it

This is the same principle used in old-style rheostats (dimmer switches) — sliding a contact along a resistive material to smoothly change resistance and brightness.

Activity 32 · Compass Needle Dance

Can electricity, invisible and silent, actually push a compass needle around?

C 2.4 · Magnetic field due to a current-carrying conductor (assessed) · Time: 15 minutes

You'll need

- A battery, connecting wires (same simple circuit)
- A small magnetic compass

Try it

1. Lay a straight wire (connected to your battery circuit, switch open) directly over/near the compass, aligned with the compass needle's resting north-south direction.
2. Close the switch briefly and watch the compass needle.
3. Reverse the battery's terminals (swap which end connects where) and repeat.
4. Move the wire further from the compass and test whether the deflection gets weaker.

Safety: Keep the switch closed only briefly each time (a few seconds) so the wire and battery don't overheat.

Think & discuss

- Did the compass needle deflect the same way both times, or opposite ways when you reversed the battery? What does that tell you about the direction of the magnetic field depending on current direction?
- What does the weakening deflection with distance tell you about how a magnetic field's strength changes as you move away from a current-carrying wire?

Connect it

This is a direct recreation of Hans Christian Oersted's 1820 discovery — the first proof that electricity and magnetism are linked, using nothing more than what you have on your desk.

Activity 33 · Homemade Electromagnet

Can you turn an ordinary iron nail into a magnet using nothing but wire and a battery?

C 2.4 · Magnetic field due to a current-carrying coil/solenoid (assessed) · Time: 20 minutes

You'll need

- A large iron nail
- About 2-3 metres of thin insulated copper wire
- A battery (1.5V-9V)
- A handful of pins or paperclips

Try it

1. Wind the copper wire tightly and neatly around the nail, leaving both ends free, for as many turns as the wire allows.
2. Connect the two free wire ends to the battery terminals briefly.
3. While connected, bring the nail's tip close to the pins/paperclips and count how many it can pick up.
4. Disconnect the battery immediately after testing and see what happens to the picked-up pins.

Safety: Keep the circuit connected for only a few seconds at a time — the wire and nail can become warm with prolonged connection.

Think & discuss

- What happened to the pins the instant you disconnected the battery, and what does that tell you about the difference between this electromagnet and a permanent magnet?
- If you doubled the number of wire turns around the nail (with the same battery), what would you predict happens to its pin-picking strength, and why?

Connect it

This exact coil-around-an-iron-core principle, scaled up, is what powers electric doorbells, junkyard cranes that lift scrap metal, and the electromagnets inside a scrap-metal recycling plant.

Activity 34 · Power Detective

Your electricity bill has a story to tell — can you read it like a scientist?

C 2.4 · Electric power, and everyday applications — electricity bill, safety (assessed) · Time: 25 minutes, home-based investigation

You'll need

- A recent household electricity bill (or a photo of one)
- The wattage labels on 5-6 home appliances (bulb, fan, fridge, iron, TV, etc.)
- A calculator

Try it

1. List the wattage (in watts) printed on 5-6 appliances at home, and note roughly how many hours per day each is typically used.
2. For each, calculate the energy used per day in watt-hours (Power × Time), then convert to kWh (units) by dividing by 1000.
3. Add up all appliances' daily kWh and multiply by 30 to estimate a monthly total.
4. Compare your estimate to the actual 'units consumed' figure on your real electricity bill.

Think & discuss

- Which single appliance in your list contributes the most to your monthly electricity units, and by how much would your bill drop if you used it for one hour less per day?
- Your bill likely also mentions a sanctioned 'load' in kW/amperes — using what you know about P = VI, explain in your own words why overloading one socket with too many high-wattage appliances at once could be a fire risk.

Connect it

This is precisely how an electrician calculates whether your home's wiring and fuse rating can safely handle a new air conditioner or geyser before installing one.

Unit IV · Puzzle Corner

Electricity Word Hunt

V	H	P	C	G	T	J	C	E	U	V	F	K	Q	A
O	O	E	S	G	X	B	A	W	M	I	X	R	I	V
E	N	L	L	O	T	I	M	M	B	H	E	M	T	F
R	V	I	T	E	L	A	O	T	P	L	S	H	Y	O
S	M	N	S	A	C	E	Z	H	H	E	N	F	T	I
T	P	S	U	I	G	T	N	X	U	Y	R	I	Z	S
E	V	U	G	A	W	E	R	O	K	M	T	E	H	N
D	O	L	O	E	T	R	E	O	I	G	R	X	M	Q
A	M	A	V	G	P	Q	U	E	M	D	B	K	H	I
J	T	T	C	I	R	C	U	I	T	A	Z	V	P	L
Y	Y	O	U	U	K	F	U	S	E	X	G	B	E	Z
F	I	R	I	R	R	I	I	U	Q	L	U	N	C	J
R	E	S	I	S	T	A	N	C	E	Y	G	H	E	P
C	K	F	C	O	N	D	U	C	T	O	R	Q	X	T
J	N	T	X	A	U	N	N	Y	E	E	J	P	C	M

Find: RESISTANCE • SOLENOID • AMPERE • VOLTAGE • CONDUCTOR • INSULATOR • ELECTROMAGNET • CIRCUIT • FUSE • OERSTED

Fill in the Blanks — Electricity

1. Ohm's law states that current is directly proportional to _____, at constant temperature.
2. The SI unit of electric resistance is the _____.
3. Bulbs connected one after another in a single loop are said to be connected in _____.
4. A coil of insulated wire wound around an iron core, that behaves like a magnet only when current flows, is called an _____.
5. The rule used to find the direction of force on a current-carrying conductor in a magnetic field is _____.

Unit V

Natural Resources

Theme: Natural Resources · Exam weightage: 5 marks · 4 activities

> The smallest unit by marks, but a natural bridge to real, ongoing environmental habits — every activity here can keep running long after the exam is over.

Activity 35 · Trash Sort Challenge

If you had to sort your own household's daily waste with your bare hands (safely), would you actually know what goes where?

Natural Resources · Biodegradable and non-biodegradable substances (assessed) · Time: 20 minutes

You'll need

- A collection of clean, dry waste samples from home: a fruit peel, a piece of paper, a plastic wrapper, a leaf, a bit of cloth, a small piece of glass/metal (handled by an adult only if sharp)
- 3 labelled boxes: Wet/Biodegradable, Dry Recyclable, Reject

Try it

1. Lay out all your clean waste samples on a table.
2. Sort each one into the 3-bin system used by most Indian municipalities.
3. For each item, predict (in writing) roughly how long you think it would take to decompose if buried in soil: days, months, years, or centuries.
4. Compare your predictions with your group's, and discuss any big disagreements.

Think & discuss

- Which items surprised you most in terms of how long they might take to break down?
- Design one simple rule your own household could follow this week to make sorting waste at the source easier and more consistent.

Connect it

This 3-bin system (wet/dry/reject) is the actual rule most Indian municipal corporations now require households to follow for daily waste collection.

Activity 36 · Bury and Watch

What really happens underground to the things we throw away?

Natural Resources · Biodegradable and non-biodegradable substances (assessed) · Time: 15 minutes to set up, then a 2-week and 1-month check

You'll need

- A small fruit peel, a piece of paper, and a small piece of plastic wrapper — each placed inside its own small mesh bag or old stocking, individually labelled
- A pot of soil or a corner of a garden

Try it

1. Bury each labelled mesh bag a few centimetres deep in the same patch of soil, noting the exact spots.
2. Water the area lightly like the rest of the garden, on the same schedule.
3. After 2 weeks, carefully dig up all three bags, observe, photograph/sketch, and rebury them.
4. After 1 month, dig them up a final time and record your final observations.

Think & discuss

- Which material showed the most visible change after 2 weeks, and which showed almost none even after a month?
- Based on this, estimate how many months or years the plastic sample might take to fully decompose, and explain what problems that timescale could cause in a real, unmanaged landfill.

Connect it

This mirrors real long-term landfill studies that show plastic waste from decades ago still intact today — your mesh bags are a miniature version of the same evidence.

Activity 37 · Mini Ecosystem in a Bottle

Can you build a tiny world that takes care of itself, with no daily watering?

Natural Resources · Ecosystem (assessed) · Time: 30 minutes to build, observe over several weeks

You'll need

- A clear, wide-mouthed jar or bottle with a lid
- A layer of small pebbles/gravel
- A layer of soil
- A small hardy plant or a few seeds (moss, grass, or a small succulent cutting)
- A little water

Try it

1. Layer pebbles at the bottom of the jar (for drainage), then a layer of soil on top.
2. Plant your seedling/cutting or scatter seeds into the soil.
3. Add just enough water to dampen the soil, without pooling.
4. Seal the jar with its lid and place it somewhere with indirect light. Observe weekly without opening it.

Think & discuss

- After a week or two, you may notice droplets forming on the inside of the jar's walls in the morning and clearing by afternoon. What natural cycle is this mimicking in miniature?
- What would happen to your mini ecosystem if you sealed it with no plant inside at all, only soil and water? Why does the plant matter to keeping the system going?

Connect it

This sealed-jar ecosystem is a small working model of Earth itself — a mostly closed system where matter (like water) cycles endlessly, but energy must keep entering from an outside source (light).

Activity 38 · Ozone Hero Pledge

Which everyday item in your own home might be quietly linked to ozone depletion?

Natural Resources · Ozone depletion (assessed) · Time: 20 minutes, home investigation + written pledge

You'll need

- A notepad
- Access to check labels/manuals of home appliances (fridge, AC) if available

Try it

1. List all cooling appliances at home (fridge, air conditioner, cooler) and, if possible, check their manuals or labels for the refrigerant gas they use.
2. Research (or recall from class) which refrigerant gases were historically linked to ozone depletion, and which newer ones are considered safer.

3. Identify one household habit (like servicing an AC only at authorised centres, rather than informal repair that vents old gas into the air) that could reduce ozone-depleting emissions.
4. Write a short, one-paragraph household pledge listing 2-3 specific actions your family will commit to.

Think & discuss

- Why does a gas leaking from a home appliance in your city end up affecting the ozone layer high above Antarctica — how does something so local become a global problem?
- Which of your 2-3 pledged actions is the easiest for your household to actually keep, and which is the hardest? Why?

Connect it

This activity models exactly how the real 1987 Montreal Protocol worked — millions of small household and industrial choices, added together, reversed a global environmental problem.

Unit V · Puzzle Corner

Match the Waste to Its Approximate Decomposition Time

Column A	Column B
1. Banana peel	A. 2-5 days
2. Paper	B. 10-20 years / does not fully decompose
3. Plastic bag	C. 2-5 months
4. Glass bottle	D. 1-2 million years (or longer)

Odd One Out

1. Fruit peel • Plastic wrapper • Paper • Leaf

2. Ozone depletion • Photosynthesis • Global warming • Waste accumulation

Answer Key — Puzzle Corners

Unit I — Chemical Substances — Nature and Behaviour

Chemistry Word Hunt

All 10 words are hidden reading left-to-right, top-to-bottom, or diagonally. Words: OXIDATION, REDUCTION, DISPLACEMENT, PRECIPITATE, CATALYST, VALENCY, CORROSION, REACTIVITY, ISOMER, HYDROCARBON.

Unscramble the Reaction Types

1. NOOICMNBAIT → COMBINATION
2. SOICMOTIONDEP → DECOMPOSITION
3. TECPLADSMEN → DISPLACEMENT
4. MOHECTREXIC → EXOTHERMIC
5. IDNOCETMRHE → ENDOTHERMIC
6. OXTDNAOII → OXIDATION

Match the Compound to Its Common Name

1. Sodium hydrogen carbonate → Baking soda
2. Sodium hydroxide → Caustic soda
3. Calcium sulphate hemihydrate → Plaster of Paris
4. Sodium carbonate → Washing soda
5. Calcium oxychloride → Bleaching powder

Unit II — World of Living

Biology Word Hunt

All 10 words are hidden reading left-to-right, top-to-bottom, or diagonally. Words: STOMATA, TROPISM, REFLEX, HORMONE, PISTIL, STAMEN, HEREDITY, MUTATION, OVULE, NASTIC.

Fill in the Blanks — Life Processes

1. stomata
2. phototropism
3. reflex action
4. stamen
5. pea

Odd One Out

1. Pupil (the other three are plant transport/exchange structures)
2. Phototropism (the other three are chemical reaction types)
3. Copper sulphate (the other three are natural/standard pH indicators)

Unit III — Natural Phenomena

Unscramble the Optics Terms

1. OCACNVE → CONCAVE
2. VECXNO → CONVEX
3. TRAOCFIRNE → REFRACTION
4. PROSDINSEI → DISPERSION
5. TRATCESGIN → SCATTERING
6. OFACL HELTGN → FOCAL LENGTH

Match the Term to Its Meaning

1. Myopia → Ability to see nearby objects clearly, but not distant ones

2. Hypermetropia → Ability to see distant objects clearly, but not nearby ones
3. Magnification → Ratio of image height to object height
4. Refractive index → A measure of how much a medium bends light
5. Power of a lens → The reciprocal of a lens's focal length (in metres)

Unit IV — Effects of Current

Electricity Word Hunt

All 10 words are hidden reading left-to-right, top-to-bottom, or diagonally. Words: RESISTANCE, SOLENOID, AMPERE, VOLTAGE, CONDUCTOR, INSULATOR, ELECTROMAGNET, CIRCUIT, FUSE, OERSTED.

Fill in the Blanks — Electricity

1. potential difference (voltage)
2. ohm
3. series
4. electromagnet
5. Fleming's Left Hand Rule

Unit V — Natural Resources

Match the Waste to Its Approximate Decomposition Time

1. Banana peel → 2-5 days
2. Paper → 2-5 months
3. Plastic bag → 10-20 years / does not fully decompose
4. Glass bottle → 1-2 million years (or longer)

Odd One Out

1. Plastic wrapper (the other three are biodegradable)
2. Photosynthesis (the other three are environmental problems, not a natural process)

Appendix — Curricular Goals & Competencies Map

For lesson planning: every activity in this book is tagged with the CBSE Curricular Goal / Competency code it primarily builds, and whether that topic is summatively assessed in the 2026-27 year-end exam or only formatively (Portfolio / Periodic Assessment). Use this table to slot activities into your teaching plan alongside the textbook chapters.

Unit I — Chemical Substances — Nature and Behaviour (25 marks)

Only "Chemical Reactions and Equations" is assessed in the year-end written exam this year. Periodic Classification, Acids-Bases-Salts, Metals & Non-metals, and Carbon Compounds are taught the same way but assessed formatively (Portfolio / Periodic Assessment) — so treat every activity below as equally worth doing, just not equally worth cramming.

Code	Competency
C 1.1	Classification of elements; compound formation (Bohr's model, valency)
C 1.2	Nature and properties of chemical substances, mixtures, solutions
C 1.3	Representing chemical change with symbols and equations

Activities in this unit:

Fizz Detective • Hot or Cold? • The Corrosion Diary • The Colour-Changing Nail • Kitchen Rainbow • Sour to Sweet • The Great Metal Race • Element Rangoli • Molecule Modelling with Toothpicks and Peas • Name That Compound • Kitchen Chemistry Cabinet

Unit II — World of Living (25 marks)

Life Processes, Control & Coordination, Reproduction, and Heredity are all assessed in the written exam. Evolution is taught but assessed only formatively (Portfolio) — still worth the timeline walk, since it ties Heredity and Evolution together conceptually.

Code	Competency
C 3.2	Life processes — nutrition, transport, exchange of materials, reproduction
C 4.4	Patterns of inheritance of traits (Mendel's laws)
C 4.5	Evidence of biological evolution and natural selection

Activities in this unit:

Breath of Life • Leaf's Secret Pores • Chasing the Light • Root Compass • Touch-Me-Not Investigation • Reflex & Reaction Time Lab • Ballooning Bean • Flower Detective • Family Tree of Traits • Fossil Story Timeline Walk • Myth or Fact?

Unit III — Natural Phenomena (12 marks)

This whole unit — reflection, refraction, lenses, the eye, and dispersion — is assessed in the written exam. Every activity below is a frugal, at-home preview before you handle the actual lab mirrors, lenses, and prism in school.

Code	Competency
C 2.3	Curved mirrors and lenses; image characteristics; ray diagrams

Activities in this unit:

Spoon Mirror Magic • Bent Straw, Vanishing Coin • Distant Window Focus • Shoebox Eye Model • Bathroom Rainbow • Milk & Torch

Unit IV — Effects of Current (13 marks)

Every activity here uses only low-voltage dry cells (1.5V-9V) — never mains electricity. This whole unit, including magnetic effects, is assessed in the written exam; the motor, electromagnetic induction, and generator are formative-only additions.

Code	Competency
C 2.4	Circuit properties (current, voltage, resistance), Ohm's law, everyday applications

Activities in this unit:

Build Your Own Simple Circuit • Lemon Power Station • Resistance Detective • Compass Needle Dance • Homemade Electromagnet • Power Detective

Unit V — Natural Resources (5 marks)

The smallest unit by marks, but a natural bridge to real, ongoing environmental habits — every activity here can keep running long after the exam is over.

Code	Competency
C 2.8	Interconnected earth systems, environmental hazards

Activities in this unit:

Trash Sort Challenge • Bury and Watch • Mini Ecosystem in a Bottle • Ozone Hero Pledge